the ENERGY lab

Fire in the Ice

2014 Vol. 14, Issue 2 Methane Hydrate Newsletter

CONTENTS

CONTACT

Ray Boswell
Technology Manager—Natural Gas Technologies, Strategic Center for Natural Gas and Oil

412-386-7614
ray.boswell@netl.doe.gov

U.S. DEPARTMENT OF ENERGY

Gas Hydrate Assessment in the Northern Gulf of Mexico: Preliminary Results Reveal New Prospects

Urmi Majumdar[1], Ann Cook[1], Samrya Ismail[1], Matthew Frye[2], William Shedd[2]

[1]School of Earth Sciences, Ohio State University
[2]United States Bureau of Ocean Energy Management

Introduction

We are in the process of evaluating the presence of natural gas hydrate in the northern Gulf of Mexico using petroleum industry well logs available in the area. More than 1500 industry wells that penetrate the gas hydrate stability zone (GHSZ) have been drilled over the past few decades in the northern Gulf of Mexico, though less than half have well log data within the GHSZ.

We have completed a preliminary assessment of four protraction areas (large lease areas), including Alaminos Canyon, East Breaks, Keathley Canyon, and Garden Banks. In these areas, we have identified 132 wells that contain suitable well logs within the GHSZ (Figure 1).

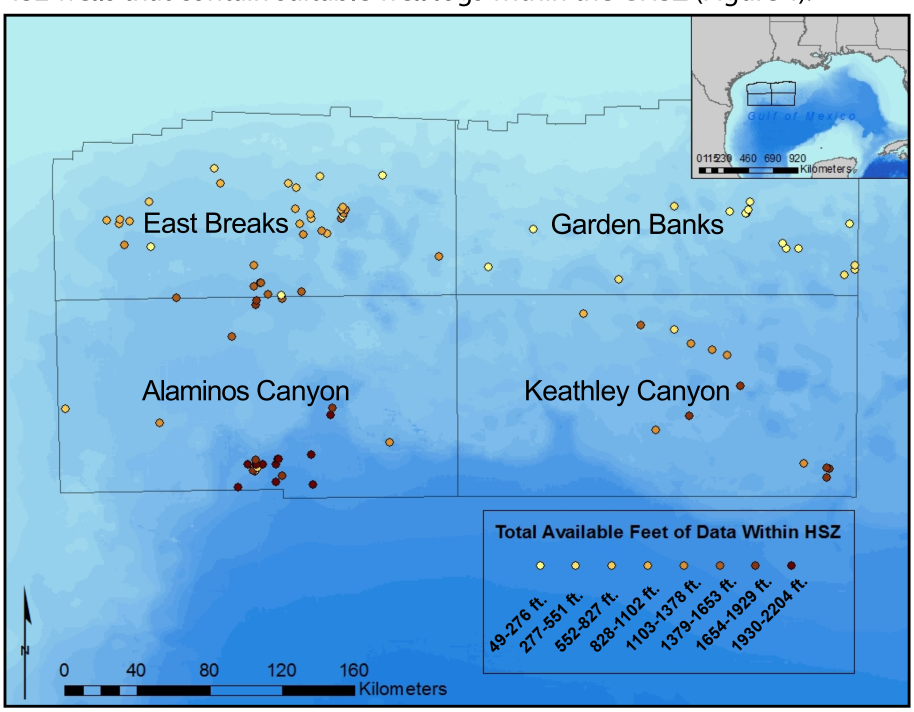


Figure 1: Industry wells (132 total) assessed for gas hydrate in Alaminos Canyon, East Breaks, Keathley Canyon, and Garden Banks protraction areas in the Gulf Mexico. The map shows the total feet of available data within the GHSZ in the wells.

National Energy Technology Laboratory

1450 Queen Avenue SW
Albany, OR 97321
541-967-5892

420 L. Street, Suite 305
Anchorage, AK 99501
907-271-3618

3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507-0880
304-285-4764

626 Cochrans Mill Road
P.O. Box 10940
Pittsburgh, PA 15236-0940
412-386-4687

13131 Dairy Ashford, Suite 225
Sugar Land, TX 77478
281-494-2516

Visit the NETL website at:
www.netl.doe.gov

Customer Service:
1-800-553-7681

Fire in the Ice is published by the National Energy Technology Laboratory to promote the exchange of information among those involved in gas hydrates research and development.

This newsletter is available online at http://www.netl.doe.gov/research/oil-and-gas/methane-hydrates

Interested in contributing an article to *Fire in the Ice*?
This newsletter now reaches more than 1400 scientists and other individuals interested in hydrates in sixteen countries. If you would like to submit an article about the progress of your methane hydrates research project, please contact Karl Lang at 724-554-3680 or karl.lang@contr.netl.doe.gov

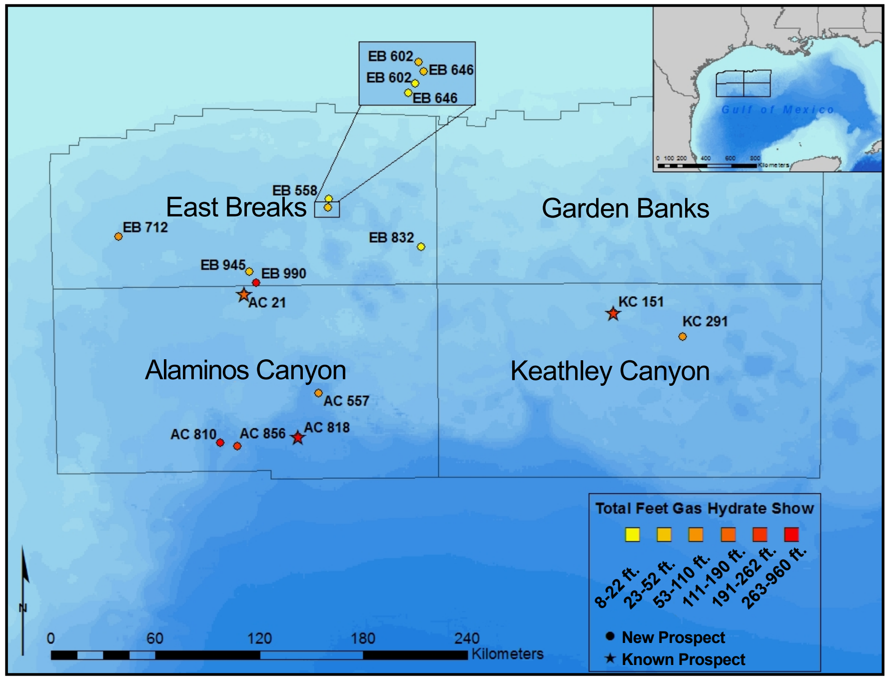


Figure 2. Industry wells that likely contain gas hydrate in the four protraction areas analyzed in the Gulf of Mexico. The map includes all gas hydrate prospects, including new prospects identified in this study (dots) and known prospects (stars). No gas hydrate prospects were discovered in Garden Banks, which is not surprising, because wells in Garden Banks have the least data available in the GHSZ (Figure 1).

We have found three new gas hydrate prospect in Alaminos Canyon, seven new gas hydrate prospects in East Breaks, and one new gas hydrate prospects in Keathley Canyon (Figure 2).

Methodology

The primary geophysical logs used for this gas hydrate assessment are resistivity and gamma ray logs, because they are widely available within the GHSZ in the northern Gulf of Mexico, and they can be used together to better understand potential accumulations of gas hydrate. Gamma ray logs measure the natural radiation of the sediment and qualitatively indicate the presence of sand-rich (lower gamma ray) or clay-rich (higher gamma ray) sediments. Resistivity logs record the electrical resistivity of the bulk sediment system, and these are helpful because the presence of hydrate in the system is known to increase its overall resistivity.

In shallow, water-saturated sediments in the GHSZ, resistivity is usually close to 1 Ωm. In each well analyzed in this study, we establish a background resistivity and consider a 1 Ωm or greater increase in resistivity beyond this background as an indicator of natural gas hydrate. Of course, other factors, such as sediment cementation or compaction, can also cause a resistivity increase. However, several sites show very high resistivity, i.e., greater than 5 Ωm within the GHSZ, which strongly suggests the presence of gas hydrate.

Alaminos Canyon 810

We have identified an exciting gas hydrate prospect in Alaminos Canyon, at well AC 810 (Figure 3), which was drilled by Statoil Gulf of Mexico LLC

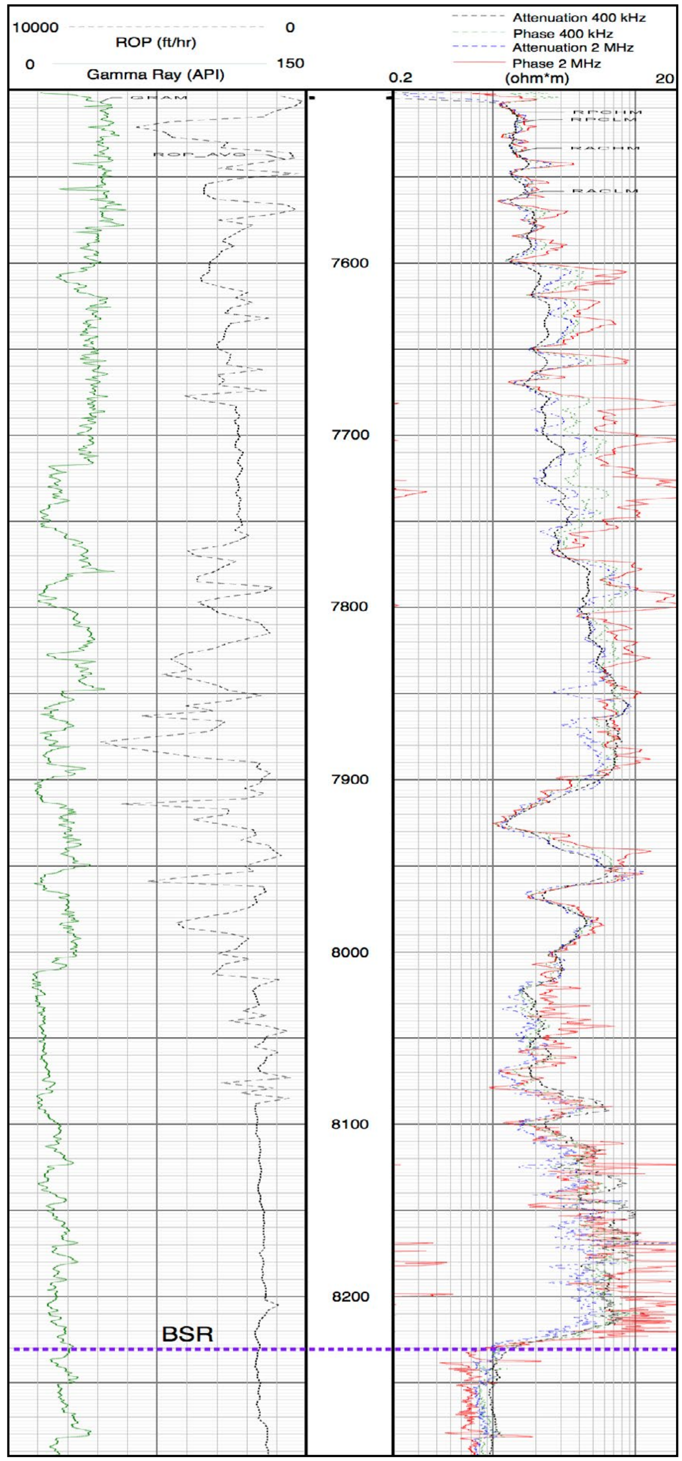


Figure 3 : Gamma ray (left) and resistivity (right) logs for well AC 810. Depths are in log feet, measured from the drill floor at 106 feet above sea level. Gas hydrate is most likely present from top of log at 7500 feet to 8230 feet log depth. The seismically-determined BSR is shown at 8230 feet.

in 2010. Based on the log signatures, we interpret a thick interval of gas hydrate-bearing strata from the top of the log, at 7500 feet, to a log depth of 8230 feet. Note that the bottom of this interval, at 8230 feet, corresponds closely with the depth of the bottom-simulating reflector (based on seismic imaging) and with the theoretical base of the GHSZ (based on estimated temperature and pressure conditions) at this location. There is a general decrease with depth in the gamma ray signature throughout the interval from 7500 to 8230 feet log depth, which we interpret as an overall coarsening of the sediment in the GHSZ with depth.

The sediment column in the GHSZ can be divided into two lithologic units, based on the gamma ray and resistivity logs. The thicker, top unit, from 7500 to 8010 feet log depth, is a clay-rich unit that likely contains near-vertical gas hydrate-filled fractures, as interpreted from the propagation resistivity curve separation in that interval. The resistivity response ranges from 2 Ωm to 30 Ωm in this unit, as compared to the background resistivity for the well, which is about 0.8 Ωm.

A decrease in the gamma ray response near a log depth of 8010 feet demarcates this upper, clay-rich unit from a lower unit with a different log character. At 8010 feet, there is also a decrease in the resistivity curve separation, suggesting that the lower unit is coarser and sandier than the interval above it. The log signatures suggest that hydrate may occur in the primary pore spaces of this lower unit. The resistivity from 8010 to 8230 feet log depth ranges from 2 Ωm to 40 Ωm, and the resistivity increases toward the bottom of the sandy interval indicating an increase in gas hydrate saturation with depth.

Summary

Preliminary results of our gas hydrate assessment in the northern Gulf of Mexico suggest that hydrate occurs in locations that were not previously documented. We intend to continue this assessment to include all protraction areas in the Gulf of Mexico, and we hope to find additional gas hydrate prospects for future follow-up work. More information on this project can be found in Majumdar *et al.*, 2014 (see below), a paper prepared for presentation at the upcoming International Conference on Gas Hydrates, to be held in Beijing, China.

Recommended Reading

Boswell, R., Collett, T., Frye, M., Shedd, W., McConnell, D.R., and Shelander, D., 2012. Subsurface gas hydrates in the northern Gulf of Mexico. Marine and Petroleum Geology, v. 34, pp. 4-30.

Cook, A.E., Anderson, B.I., Malinverno, A., Mrozewski, S., and Goldberg, D.S., 2010. Electrical anisotropy due to gas hydrate-filled fracture planes. Geophysics, v. 75, no. 6, pp. F173-F185.

Frye, M., 2008. Preliminary evaluation of in-place gas hydrate resources: Gulf of Mexico outer shelf. Minerals Management Service Report 2008-004.

Majumdar, U., Cook, A., Ismail, S., Frye, M., and Shedd, W., 2014. A new approach in determining the occurrences of natural gas hydrate in the northern Gulf of Mexico using existing petroleum industry well logs. Proceedings of the 8th International Conference on Gas Hydrates (ICGH8-2014), Beijing, China, 28 July - 1 August, 2014.

A Global Review of Gas Hydrate Resource Potential[1]

Thomas Reichel and Joseph W. Gallagher, Statoil ASA, Oslo, Norway

Introduction

There is little doubt that global resources of conventional hydrocarbons are on the decline. Hydrocarbons will continue to be a crucial source of energy for many decades to come; hence many independent oil companies, academic institutions, and government agencies have initiated programs to investigate the possibility of exploiting gas hydrate resources to make up the expected hydrocarbon shortfall.

We carried out a global screening of deep marine and Arctic basins to define and rank the world's most prospective areas for gas hydrate resources. A risking approach, based on that routinely applied in conventional exploration, was used to evaluate and risk basins for hydrocarbon source, gas migration pathways, reservoir properties, and sealing capabilities of the sediments. Seismic data, well logs, and other relevant data, including public domain data, have been analyzed. Approximately 500 onshore and offshore basins were evaluated and ranked, and several basins reveal good to very good gas hydrate potential. Examples are presented to outline the approach taken and to illustrate some of the characteristics of typical prospective gas hydrate accumulations. Technological developments, gas prices, and increasing energy demand will determine if and when these resources will be exploited on a large scale.

Methods

To better define and rank worldwide gas hydrate resources, we applied a conventional petroleum systems approach. Onshore and offshore basins were evaluated using conventional 2D and 3D seismic, well log data, and additional publicly available data in order to investigate the gas hydrate potential – both in terms of hydrate presence and exploitability.

Whether gas hydrates are present in a basin or not is highly dependent on present-day temperature and pressure conditions. Stable gas hydrate conditions can be found in onshore basins within Arctic regions, where permafrost provides a sufficiently cold environment; and in offshore basins characterized by water depths generally greater than approximately 300m.

Following these criteria, we first reviewed 500 global basins to determine the presence and extent of the gas hydrate stability zone (GHSZ). A conventional petroleum system approach was then used to further analyze and characterize the most prospective basins.

---

1 This article is modified from a conference paper entitled "Global Screening of Gas Hydrates," which was presented in May, 2014 at the Offshore Technology Conference in Houston, Texas. It is reprinted here with permission of the Society of Petroleum Engineers, license number 3405321091105.

Important hydrocarbon system components are:

- Presence of a hydrocarbon source
- Possibility of hydrocarbon migration into the GHSZ
- Reservoir presence (sand) within the GHSZ
- Reservoir seal (shale/mud) above a potential hydrate reservoir

Each basin was ranked for its gas hydrate potential based on the presence or absence of these components. In addition, the ranking of each basin was adjusted based on a data confidence factor, so that basins with more available data were given a higher overall weighting than basins with less data (Figure 1). In some basins, the data confidence was sufficiently high, with good well log information and 3D seismic coverage to warrant a more detailed resource assessment.

Seismic data is the principle input to screening the gas hydrate potential within a basin. In marine sediments, the base of the GHSZ is very often characterized by a bottom-simulating reflector (BSR). To find hydrate accumulations in potentially prospective concentrations, the section within the GHSZ was studied in detail for key seismic features. These features include: units of high impedance; units with strong, locally-bounded high amplitudes (Figure 2); and phase reversals that appear along individual seismic units and crosscut the GHSZ (Figure 3).

Figure 1. Global screening map summarizing basins reviewed and the method and main risking parameters used in basin ranking.

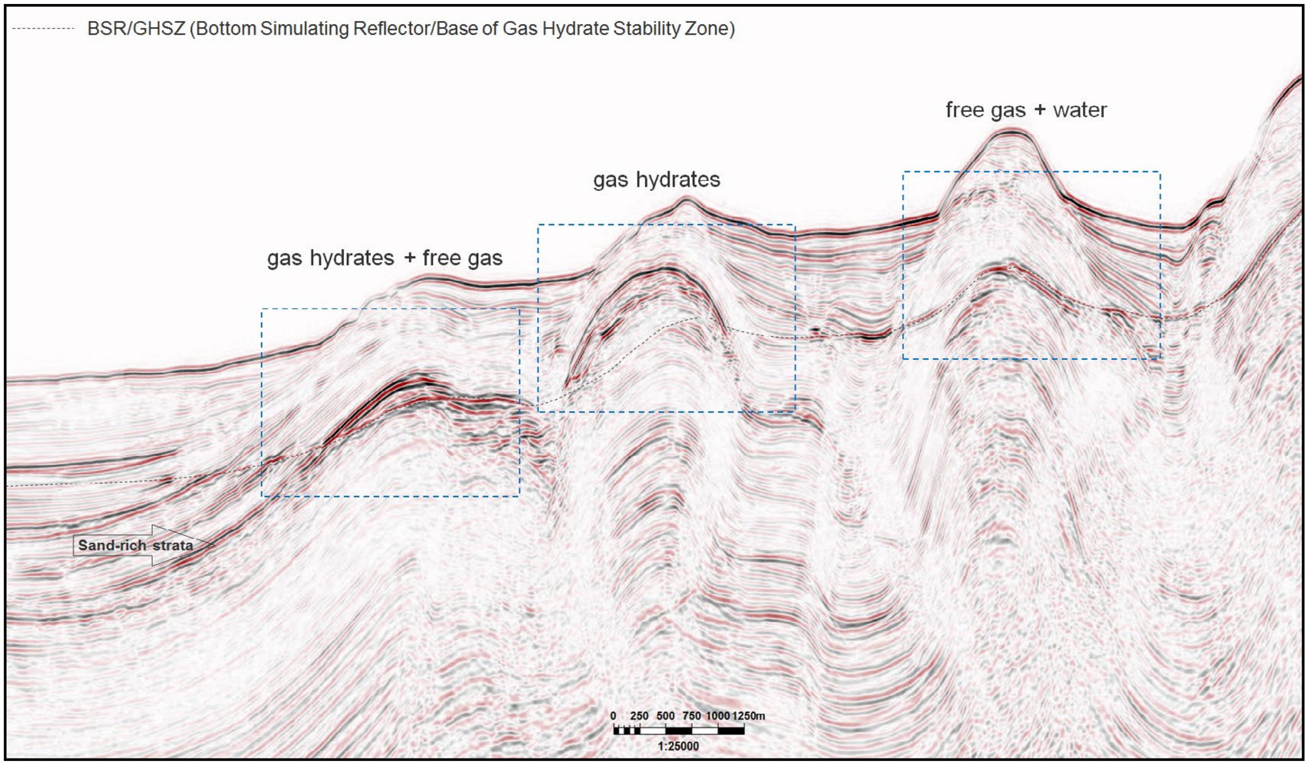


Figure 2. Offshore basin in which a sand-rich sedimentary section impinges on the GHSZ (dashed line) at the crest of three folds. In the fold to left, strong amplitudes and well-developed BSR suggest gas hydrate fill in reservoir quality sand overlying potential free gas deposits. In the fold to the center, the full reservoir is located well within the GHSZ, with little evidence of free gas. To the right, the reservoir does not enter in the GHSZ and is interpreted to be gas-charged.

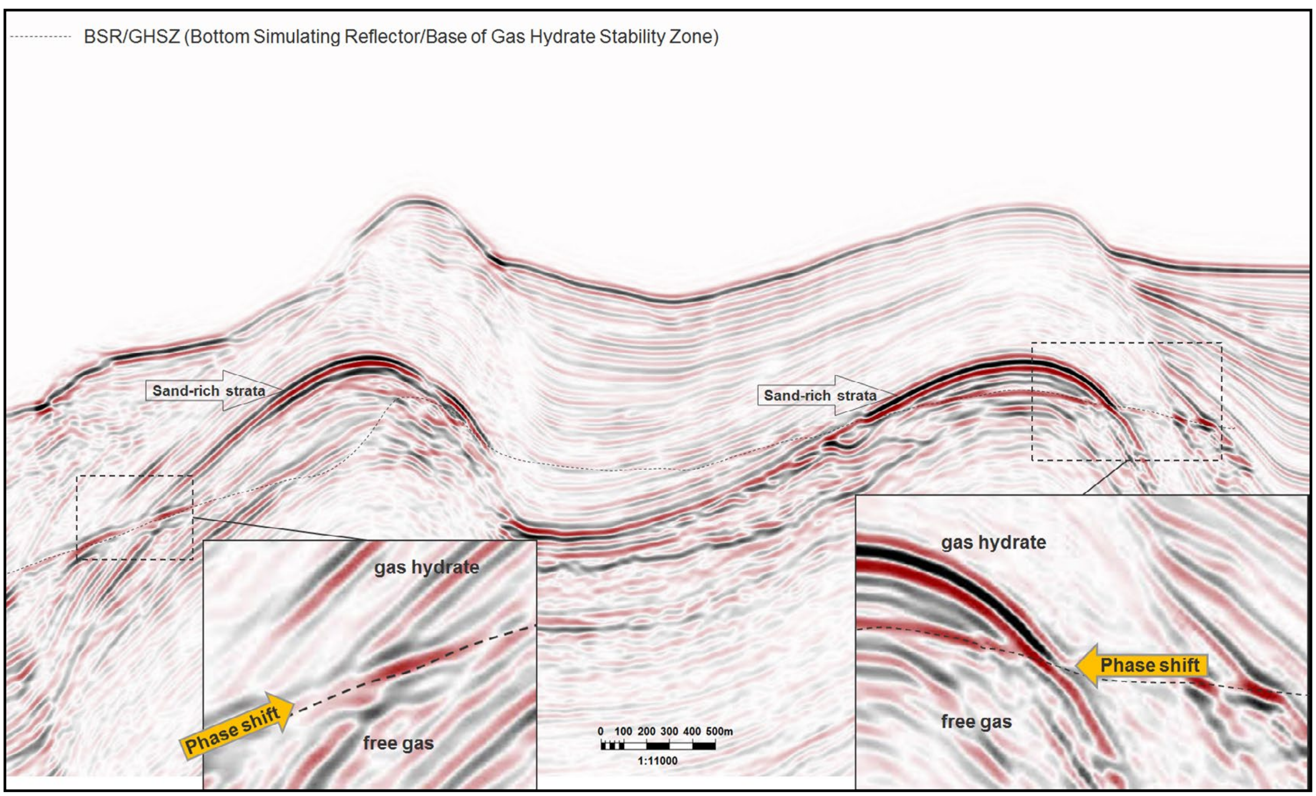


Figure 3. Offshore basin showing an interpreted reservoir-quality sand that is charged with gas hydrate on the fold crests and with free gas between the folds. Boxes show details of seismic response where the prospective horizon crosses the base of the GHSZ, including the phase shift associated with change from gas hydrate to free gas pore fill.

Preliminary Results

In total, 567 basins were analyzed, and 256 basins were found to contain areas favorable for hydrate stability. Of these, 197 were evaluated in detail. Of the 197 basins analyzed in detail, 14 showed good potential for gas hydrate accumulations reservoired in sand-prone sediments. Resource assessments have been performed on the most promising basins.

Based on this study, we can expect to discover several prospects in each of the Top 10 basins. Initial calculations have revealed volumes of up to 5 trillion cubic feet methane in some of these prospects.

Recommended Reading

Dai, J., Xu, H., Snyder, F., and Dutta, N., 2004. Detection and estimation of gas hydrates using rock physics and seismic inversion: Examples from the northern deepwater Gulf of Mexico, The Leading Edge, v. 23, pp. 60–66.

Dai, J., Snyder, F., Gillespie, D., Koesoemadinata, A., and Dutta, N., 2008. Exploration for gas hydrates in the deepwater, northern Gulf of Mexico: Part 1: A seismic approach based on geologic model, inversion, and rock physics principles, Marine and Petroleum Geology, v. 25, no. 9, pp. 830–844.

Klauda, J.B. and Sandler, S.I., 2005. Global Distribution of Methane Hydrate in Ocean Sediment, Energy & Fuels, v. 19, pp. 459–470.

Kvenvolden, K.A., 1988. Methane hydrate - A major reservoir of carbon in the shallow geosphere? Chemical Geology, v. 71, pp. 41–51.

McConnell, D. and Kendall, B., 2002. Images of the base of gas hydrate stability, northwest Walker Ridge, Gulf of Mexico, OTC Paper 14103.

McConnell, D., and Zhang, Z., 2005. Using acoustic inversion to image buried gas hydrate distribution: Fire in the Ice, NETL Methane Hydrate newsletter, v. 5, no. 4, pp. 3–5.

Milkov, A.V., 2004. Global estimates of hydrate-bound gas in marine sediments: How much is really out there? Earth Science Reviews, v. 66, pp. 183–197.

Saeki, T., Fujii, T., Inamori, T., Kobayashi, T., Hayashi, M., Nagakubo, S., and Takano, O., 2008. Extraction of methane hydrate concentrated zone for resource assessment in the eastern Nankai Trough, OTC Paper 19311.

Wallmann, K. *et al*., 2012. The global inventory of methane hydrate in marine sediments: A theoretical approach, Energies 5, pp. 2449–2498.

Zatsepina, O.Y. and Buffett, B.A., 1998. Thermodynamic conditions for the stability of gas hydrate in the seafloor, Journal of Geophysical Research, v. 103, pp. 24127–24139.

Prospecting for Gas Hydrate Resources

Ray Boswell (NETL), Tatsuo Saeki (JOGMEC), Craig Shipp (Shell), Matthew Frye and Bill Shedd (BOEM), Tim Collett (USGS), Dianna Shelander (Schlumberger), and Dan McConnell (Fugro).

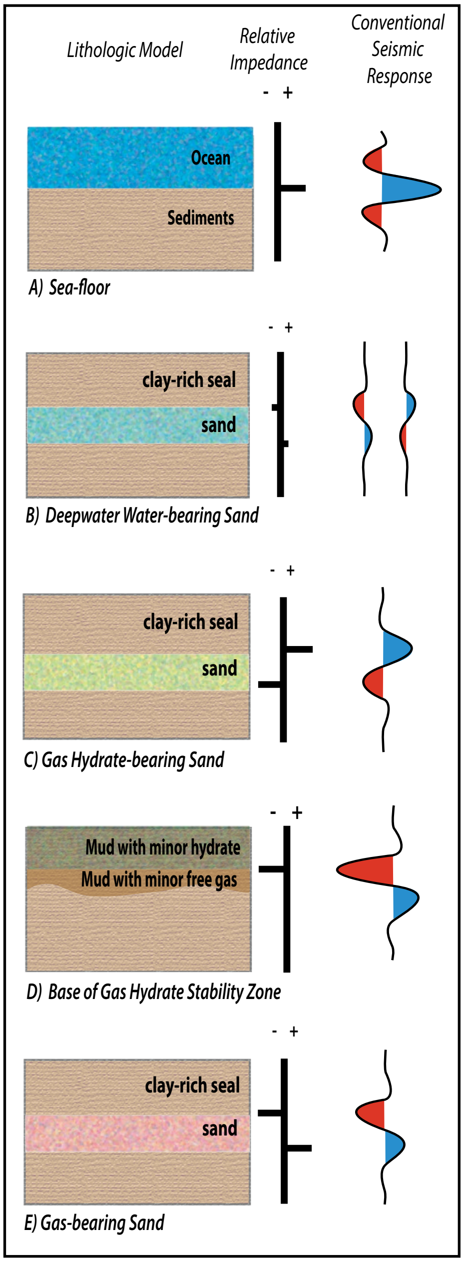


Figure 1. Schematic diagram showing the simulated seismic response to a variety of geologic models, each representing a different sedimentation history, burial depth, pore fluid type, and other factors. Geologic models include: (A) sea-floor; (B) deepwater water-bearing sand; (C) gas hydrate-bearing sand; (D) base of gas hydrate stability zone; and (E) gas-bearing sand. Seismic response follows standard North American polarity convention (00).

Introduction

While significant R&D is focused on understanding the response of gas hydrate reservoirs to various production techniques, a key element in assessing gas hydrate's resource potential is the development of viable exploration approaches. Recognizing that, at present, gas hydrates at high saturations within sediments of high intrinsic permeability are the most amenable to resource recovery, then how can such deposits be reliably located and characterized prior to drilling?

Fortunately, gas hydrate at high saturations commonly alters the physical properties of sediment in a way that can be directly imaged with the seismic data that forms the basis of marine exploration. Figure 1 shows that gas hydrate-bearing sands (fig. 1C) produce reflections that mimic the polarity of the seafloor (fig. 1A). This response (a leading blue peak in North American polarity conventions) is very different from those created by gas-bearing sands (fig. 1E) or water-bearing sands (fig. 1B). Additional care is appropriate for water-bearing sand units that occur very close to the seafloor – where lack of consolidation of the bounding clays can result in the sands weak to moderate peak reflectors.

Furthermore, the amplitude of the seismic response appears to be favorably sensitive to gas hydrate saturation (Figure 2). Setting aside tuning effects, the response becomes interpretable when saturations reach a level that is consistent with potentially significant resource targets. While gas-bearing sands can have similar amplitude responses for saturations ranging from 10% to 100%, amplitude responses from gas hydrate-bearing units scale in a predictable way, with further increases in saturation for moderate to high-level saturations. As a result, it appears that maps of gas hydrate saturation can be generated with much more confidence than maps of free gas saturation. Figure 2 also shows that loss of amplitude response (amplitude "blanking") is expected to occur at low to moderate saturations.

Recommended Exploration Process

Initial studies in the late 1970s provided a strong linkage between bottom-simulating reflectors (BSRs) and gas hydrates. For several decades thereafter, BSRs were the primary evidence sought when assessing the potential occurrence of gas hydrate. However, successful discovery of high-concentration gas hydrates in sand-rich marine reservoirs in the Nankai Trough in 1999 and 2004 revealed the limits of the BSR as a diagnostic tool for exploration and resulted in the development of a more reliable suite of indicators for sand-hosted, high-saturation occurrences. As an alternative, Saeki *et al.* (2008) and Tsuji *et al.* (2009) presented specific indicators of gas hydrate in the form of strong positive amplitudes within the gas hydrate stability zone

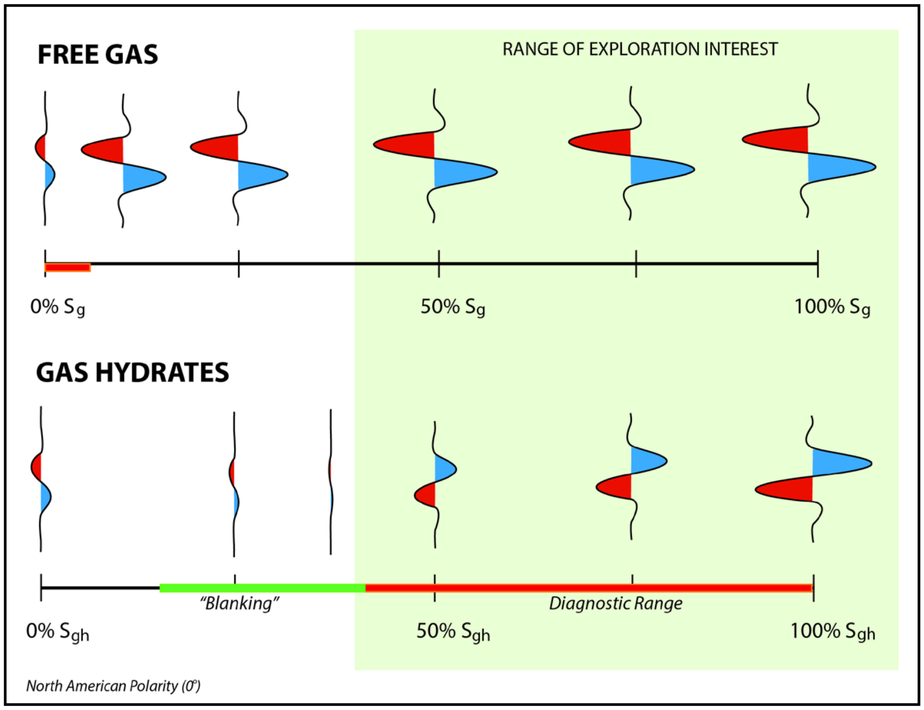


Figure 2: Schematic of seismic amplitude response to free gas and gas hydrate-bearing sands as a function of gas or gas hydrate saturation. Note the increased diagnostic value of amplitude response in the case of gas hydrates.

(GHSZ) and elevated interval velocities, as well as geologic interpretations that support the occurrence of sand-rich depositional facies. At the same time, industry deepwater shallow hazard assessment yielded insight into previously unrecognized geophysical manifestations of the base of gas hydrate stability (BGHS) that would prove to be more diagnostic of the occurrence of resource-quality deposits. In 2009, these concepts were successfully tested within the Gulf of Mexico Gas Hydrates Joint Industry Project which drilled and confirmed resource-quality gas hydrates at 2 of 3 sites drilled.

Based on exploration and drilling conducted to date throughout the world, the recommended exploration approach includes the following four steps.

Establish the extent of the GHSZ: The recognition of a BSR, regardless of its nature, is generally sufficient to define the GHSZ. With no clear BSR, the extent of GHSZ can be estimated from water depth, bottom-water temperature, subsurface pressure and temperature gradients, and gas and water geochemistry.

Prospect for seismic indicators of gas hydrate occurrence within the GHSZ: After review of available log data, prospecting begins with a review of seismic data for anomalous, high-amplitude reflections of appropriate polarity. All else being equal, such events will be most prospective where they occur at relatively greater subsea depths, because such reservoirs will be better targets due to higher temperature, displacement from the seafloor, and increased geomechanical stability of both reservoir and seal. An additional compelling direct indicator of gas hydrate occurrence is elevated interval velocity within the section between the inferred top of gas hydrate and either the BGHS or the corresponding inferred base of gas hydrate. The generation of significant positive-amplitude anomalies within mud-rich sediments by the accumulation of gas hydrate is unlikely as such sediments have not been observed to support sufficiently high saturations of gas hydrate.

Assess the occurrence of reservoir facies: Shallow, prospective, high-amplitude events can be generated by features other than gas hydrate; for example, carbonate-cemented zones, layered clays, the bases of mass transport complexes, and unconformities. Steps that can aid in discerning the most prospective targets (Figure 3) include the following.

- *Response variation across BGHS:* Highly prospective events are those in which the amplitude can be shown to reverse polarity as the event crosses the BGHS (See Figure 4 A, B). This is consistent with a change in pore fill from gas hydrate to free gas. In contrast, amplitudes that are pervasive and consistent over large areas and do not change character as the horizon is traced out of the GHSZ, are much less prospective.
- *Deposystem Interpretation:* Prospectivity is also increased if the distribution of the amplitude is consistent with the expected morphology of sand-rich deepwater depositional facies, such as sinuous channels or lobate fans.
- *Structural conformance:* Maps of the distribution of amplitudes associated with the target horizon can reduce reservoir risk by providing evidence that the amplitude is driven by a change in pore fill. For example, conformance with geologic structure such as anomalous terminations against faults and/or association with structural highs increases prospectivity.

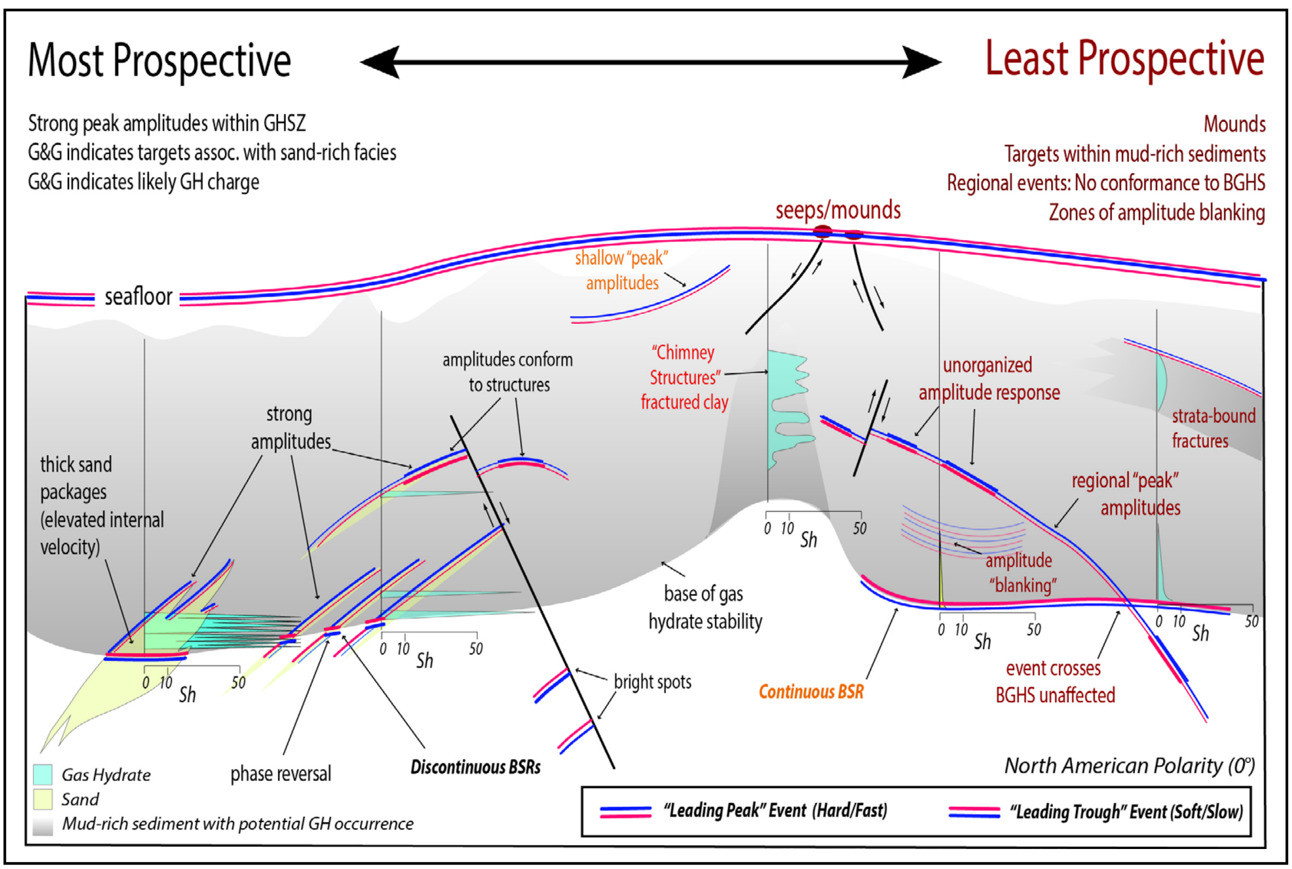


Figure 3: Schematic diagram of geophysical features commonly observed in the shallow subsurface and their relationship to prospectivity for gas hydrate resource evaluation.

- *Regional Setting:* Reservoir risk can also be mitigated through interpretation of regional trends in seismic facies. For example, sedimentary sections that show monotonous and laterally-continuous seismic reflectors are less prospective than zones of strong lateral thickness variation, including potential cut-and-fill or clear vertical aggradation, and with generally more poorly organized internal reflections. Further support for the presence of sand-rich facies can be provided through broader evaluation of the geologic history and structural configuration of the basin both regionally and locally, including the recognition of features or depositional sequences consistent with the development of coarse sediment delivery and deposition in deepwater environments.

Assess the occurrence of gas and potential delivery into the GHSZ: The evaluation described above provides strong evidence for the occurrence of gas hydrate in sand-rich sediments. Where substantial uncertainty remains, evidence that supports the presence of gas or delineates pathways in which gas is likely to have migrated into the GHSZ, are highly valuable. Such evidence can include the presence of: 1) gas chimneys (strong evidence of gas generation at depth and upward migration into the GHSZ); 2) BSRs (direct confirmation of gas presence and delivery to the BGHS); and 3) negative-polarity amplitude anomalies below

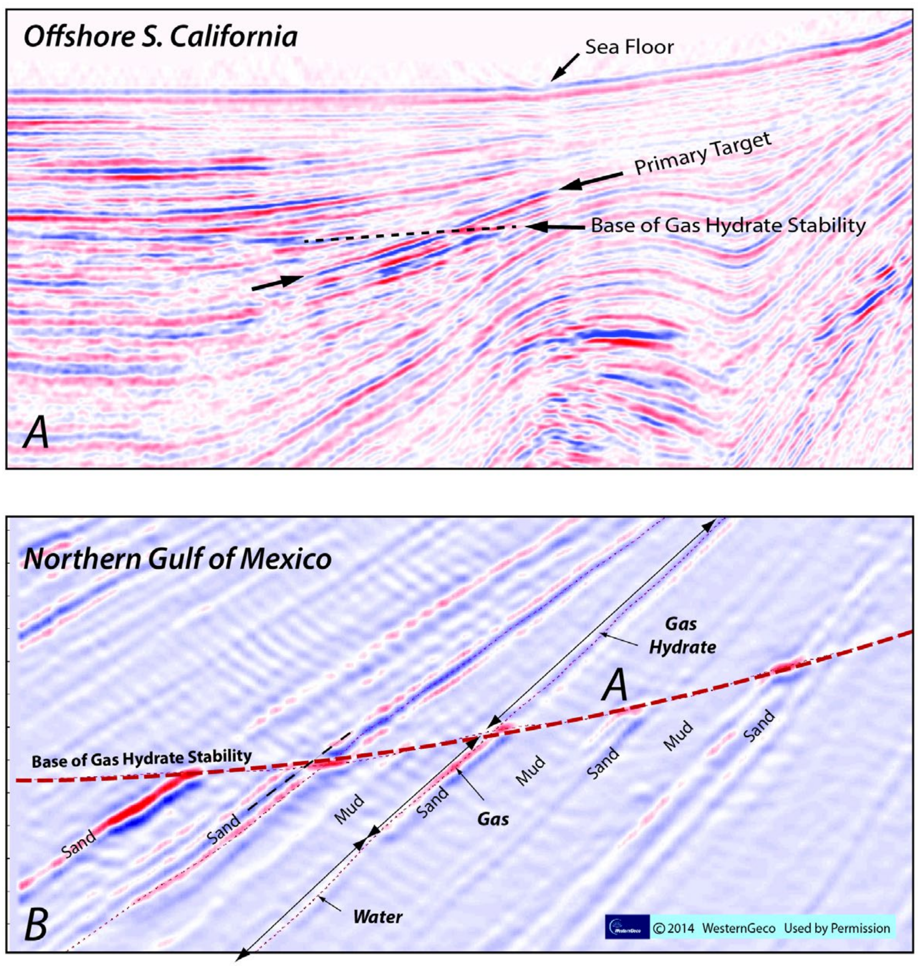


Figure 4: Examples of prospective gas hydrate occurrences from S. California (top) and N. Gulf of Mexico (bottom) showing phase reversals, where the prospective horizon crosses the inferred base of gas hydrate stability.

the BGHS. Sea-floor anomalies that are consistent with gas flux (active or past) are also informative, but may not be closely tied to gas hydrate prospectivity deeper in the subsurface.

Recommended Reading

Boswell, R., Collett, T., Frye, M., Shedd, W., McConnell, R., and Shelander, D., 2012. Subsurface gas hydrates in the northern Gulf of Mexico. J. Mar. Pet. Geo., v. 34, pp. 4-30.

Collett, T., Johnson, A., Knapp, C., and Boswell, R., 2009. Natural gas hydrates – a review, in Collett T., *et al.*, eds, Natural gas hydrates—Energy resource potential and associated geologic hazards: AAPG Memoir 89.

Collett, T. and Boswell, R., eds., 2012. Thematic set on resource and hazard implications of gas hydrates in the northern Gulf of Mexico: J. Mar. Pet. Geo. V. 34, 223 pp.

Egawa, K., Furukawa, T., Saeki, T., Suzuki, K., and Narita, H., 2013. Three-dimensional paleomorphic reconstruction and turbidite distribution prediction revealing a Pleistocence confined basin system in the northeast Nankai Trough area. AAPG Bulletin, v. 97 (5), pp. 781-798.

Lee, M., Collett, T., and Inks, T., 2009. Seismic-attribute analysis for gas-hydrate and free-gas prospects on the North Slope of Alaska, in Collett, T., Johnson, A., Knapp, C., and Boswell, R., eds., Natural gas hydrates—Energy resource potential and associated geologic hazards: AAPG Memoir 89, pp. 541–554.

McConnell, D. and Kendall, B., 2002. Images of the base of gas hydrate stability, northwest Walker Ridge. Offshore Technology Conference Paper 14103. 10 pp.

Moridis, G., Collett, T., Boswell, R., Kurihara, M., Reagan, M., Koh, C., and Sloan, D., 2009. Toward production from gas hydrates: Current status, assessment of resources, and simulation-based evaluation of technology and potential, SPE Reservoir Eval. and Eng., v. 12 (5), pp. 745-771.

Saeki, T., Fujii, T., Inamori, T., Kobayashi, T., Hayashi, M., Nagakubo, S., and Tokano, O., 2008. Extraction of methane hydrate concentrated zone for resource assessment in the eastern Nankai Trough, Japan. Offshore Technology Conference Paper 19311. 8 pp.

Shelander, D., Dai, J., Bunge, G., Singh, S., Eissa, M., and Fisher, K., 2012. Estimating saturation of gas hydrates using conventional 3-D data, Gulf of Mexico Joint Industry Project Leg II. J. Mar. Pet. Geo. v. 34, pp. 96-110.

Tsuji, Y. *et al.*, 2009. Methane hydrate occurrence and distribution in the eastern Nankai Trough, Japan: Findings of the Tokai-oki to Kumano-nada methane hydrate drilling program; in Collett, T. *et al.*, eds., Natural gas hydrates—Energy resource potential and associated geologic hazards: AAPG Memoir 89.

AGU Technical Sessions on Methane Hydrates

The Fall 2014 Meeting of the American Geophysical Union (AGU), to be held December 15-19 in San Francisco, California, will include several technical sessions on topics related to gas hydrates. These sessions are intended to foster international collaboration and information exchange among hydrate researchers from around the world. Technical sessions include:

Hydrate-bearing Soils: Characterization, Modeling, and Geomechanical Implications

Conveners: Jeen-Shang Lin, Yongkoo Seol, Marcelo Sanchez, and Tim Kneafsey

Pressure and temperature changes leading to dissociation of gas hydrates may pose serious geohazards in marine and permafrost regions. To quantify such risks requires a good grasp of the mechanical behavior of hydrate bearing soils. This is an active area of research, and the pace of the research has accelerated in recent years. This session will bring together researchers from a range of disciplines to discuss the mechanical and hydrodynamic behavior of hydrate-bearing sediments; sample preparation methods in the lab; characterization of hydrate accumulation habits in nature; impacts of hydrate dissociation on sediment properties; computational methods for modeling hydrate behavior; and case studies from around the world.

AGU Link: https://agu.confex.com/agu/fm14/webprogrampreliminary/Session1457.html

New Perspectives on the Characterization of Gas Hydrate Accumulations

Conveners: Hiroshi Fukuoka, Seth Haines, Warren Wood, and Shigeharu Aoyama

Gas hydrate accumulations worldwide are seeing increasing attention as important reservoirs of natural gas with potential significance as an energy resource, a geologic hazard, and a possible agent in climate change. Recent and ongoing geophysical and drilling programs have provided many new insights into the distribution of gas hydrate in marine and permafrost settings, as well as on the configuration and evolution of the associated gas and gas hydrate systems. These insights facilitate an improved understanding of gas hydrates as related to: (1) possible extraction, (2) seafloor slope stability and possible earthquake or thermal stress-induced landslides, and (3) its role as a part of the global carbon cycle. The conveners are interested in work targeting gas hydrate occurrences worldwide, including those found in marine, lacustrine, and permafrost settings. They welcome contributions presenting recent field, laboratory, or modeling results aimed at characterizing gas hydrate accumulations through geophysical, geochemical, or borehole techniques.

AGU Link: https://agu.confex.com/agu/fm14/webprogrampreliminary/Session3690.html

Fluid flow and gas hydrates in continental margins

Conveners: Christian Berndt and Sverre Planke

The conveners invite geoscientists addressing the dynamics of natural gas seepage and focused fluid flow in sedimentary environments at different spatial and temporal scales. Fluids are generated at different depths and migrate through the sedimentary column. They cause geological phenomena such as pipes, chimneys, mud volcanoes, cold seeps, pockmarks, or hydrothermal systems. During the ascent fluids modify their composition through mineralogical and geochemical reactions, the formation and dissociation of gas hydrates as well as biological activities that thrive in many of these extreme environments. The understanding of fluid flow processes in continental margin sediments is a major research topic relevant for ecosystems, submarine slope stability, biogeochemical cycles, and possibly climate change. The conveners welcome contributions that present the results of recent geological, geophysical and geochemical field programs, modeling studies, and ocean drilling results that give insight into the geological, geochemical and biological processes governing fluid migration and its effects.

AGU Link: https://agu.confex.com/agu/fm14/webprogrampreliminary/Session1516.html

Abstracts for these technical sessions may be submitted via the above links. The deadline for abstract submission is Wednesday, August 6th, 2014.

Announcements

Ninth International Methane Hydrate Workshop in Hyderabad, India

The 9th International Methane Hydrate R&D Workshop (IMHRDW), entitled "Fiery Ice 2014," is set to take place November 9-12, 2014 in Hyderabad, India. The workshop is designed to foster information sharing, interaction, and scientific collaboration among methane hydrate experts from all over the world. This year's workshop will cover a range of topics on the science and technology of methane hydrates, with a focus on safe and efficient production of methane from hydrate. Specific topics to be covered include: 1) detection and quantification of methane hydrate; 2) advanced logging and coring technologies; 3) hydrate laboratory studies; 4) hydrate simulation modeling; 5) production and recovery technologies; 6) methane hydrate and climate; and 7) the future of methane hydrate.

Workshop registration and technical abstract submission are open through September 15, 2014. In addition to the 3-day workshop, an optional pre-workshop field trip will take place November 9th, and two post-workshop activities are available on November 13th: a seminar on India's gas hydrate research; or a laboratory visit to India's National Geophysical Research Institute.

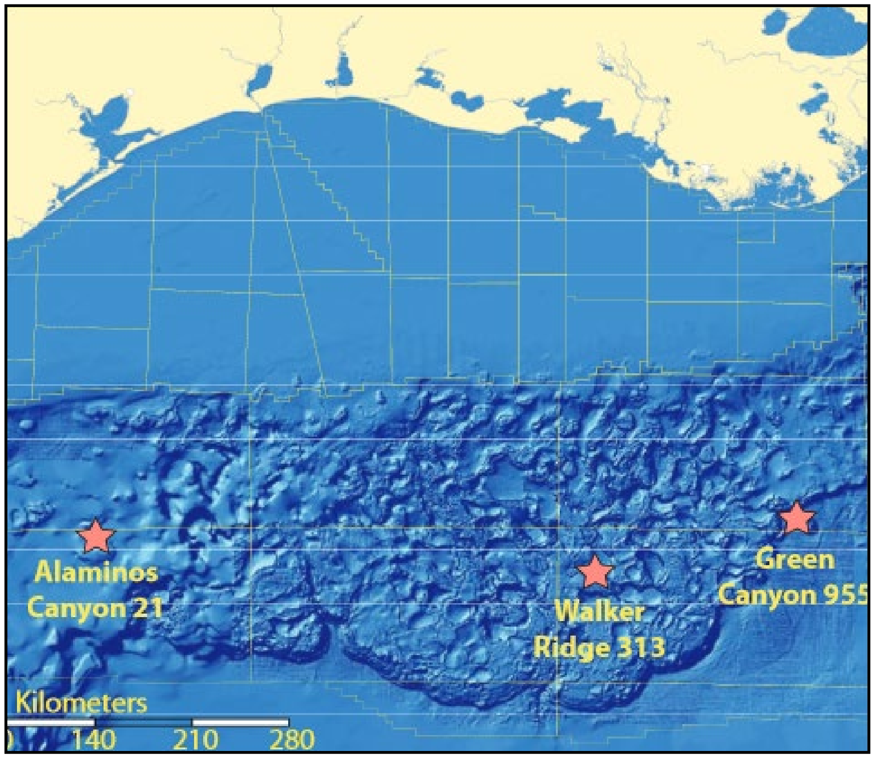
The workshop is being organized and hosted by India's National Geophysical Research Institute, under the direction of Dr. Kalachand Sain, the Head of the Gas-Hydrate Group. Workshop sponsors include India's Ministry of Earth Sciences, Ministry of Petroleum and Natural Gas, National Geophysical Research Institute, National Center for Antarctic and Ocean Research, National Institute of Oceanography, National Institute of Ocean Technology, Oil and Natural Gas Corporation Limited, Oil India Limited, and the Directorate General of Hydrocarbons. The workshop receives additional funding from the U.S. Department of Energy's National Energy Technology Laboratory.

Additional workshop information and registration details can be obtained at: www.fieryice2014.org

Gulf of Mexico JIP Leg II Well Logs Available Online

Well log data obtained by the Gulf of Mexico Gas Hydrate Joint Industry Project (JIP) in 2009 are now available for download from a public domain website. The newly available data include advanced logging-while-drilling (LWD) information from 7 gas hydrate research wells drilled during the JIP's Leg II drilling expedition in the Green Canyon, Alaminos Canyon, and

Announcements



Walker Ridge protraction areas in the northern Gulf of Mexico.

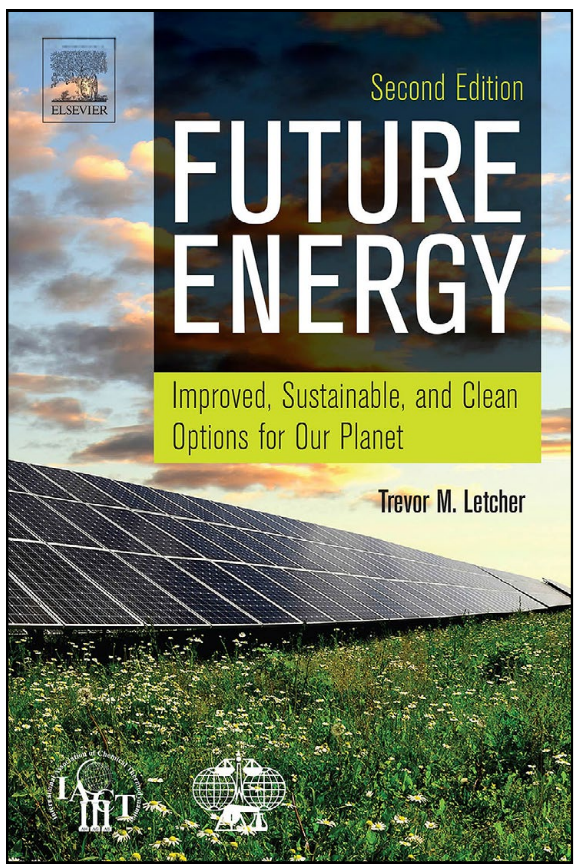
The wells were drilled to expand on earlier JIP work and, more specifically, to test for the presence and concentration of gas hydrate in sand-dominated reservoirs. Overall, the JIP Leg II findings confirmed pre-drill predictions of significant gas hydrate in sand reservoirs at these sites, and the expedition succeeded in obtaining high-quality LWD data from gas hydrate-bearing sands at all 7 wells tested.

All recorded LWD data are now available, including nuclear magnetic resonance, density, porosity, geochemistry, P- and S-wave velocities, gamma ray, inclinometry, resistivity, borehole electrical imaging, caliper, borehole seismic imaging, and temperature logs. In addition to the 2009 data, the web site also has available for download the complete log data from 4 wells drilled in 2005, during the JIP's earlier Leg I expedition.

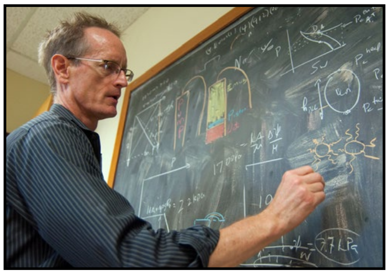
The web site is hosted by the Borehole Research Group of Columbia University's Lamont-Doherty Earth Observatory, and is located at: brg.ldeo.columbia.edu/ghp/

Future Energy Book Includes Methane Hydrate Chapter

Elsevier has published a new book, "Future Energy (2nd Edition): Improved, Sustainable, and Clean Options for our Planet," which includes an in-depth chapter on methane hydrates. The chapter was written by an international team of methane hydrate experts, including Ray Boswell (US DOE National Energy Technology Laboratory), Koji Yamamoto (Japan Oil, Gas and Metals National Corporation), Sung-Rock Lee (Korea Institute of Geoscience and Mineral Resources), Timothy Collett (US Geological Survey), Pushpendra Kumar (Keshav Dev Malviya Institute of Petroleum Exploration, India), and Scott Dallimore (Geological Survey of Canada). It includes discussions of the nature of methane hydrate; worldwide occurrences and resource assessments; field, laboratory, and numerical modeling studies of production strategies; and recommended future work. The book was published in December, 2013, with an online version released in January, 2014. For more information, please visit: http://store.elsevier.com/



Spotlight on Research



STEVEN BRYANT

Professor of Petroleum and Geosystems Engineering

The University of Texas at Austin

"Any day you learn something is a good day." This is a slogan Steve Bryant, Petroleum Engineering Professor at UT Austin, uses often on his students. It also aptly describes the way Steve lives his life—faced with a new piece of laboratory equipment or a new musical instrument, he embraces new learning challenges and inspires those around him to do the same.

Steve was born and raised in Chattanooga, Tennessee, where his father worked as an electrical engineer, and his mother did every other thing imaginable to keep the family and the household running smoothly. His father had a workbench in the garage, where he built electronic things—a home stereo, radio-controlled airplanes—and Steve spent hours in there helping out and learning how things worked. When he was not in the garage, Steve could be found testing Newton's Laws of Mechanics on his bike, riding down steep gravel roads and competing with friends to see who could sustain the longest controlled skid at the bottom without wrecking.

During middle school and high school, Steve attended McCallie School in Chattanooga, where he was inspired by excellent teachers in a broad spectrum of subjects from Latin, to English Literature, to Mathematics. At some point during high school, it became clear that he had a talent for math and science, and he knew that an engineering degree was a practical choice that would likely lead to a good job in industry. Steve applied to Vanderbilt University and received a full scholarship to study engineering.

During his youth, Steve also developed a love of bluegrass music, thanks to countless informal jam sessions with his dad. Steve learned to play guitar at age 12 and banjo at 14, but it did not stop there. He went on to learn mandolin, dobro, and bass, and he still considers playing music with friends and family to be one life's most gratifying endeavors. Steve says: "Playing music yourself is fun; playing music with other people is satisfying and joyous in a way that is unlike anything else I know." Steve is fascinated by the creative process and feels fortunate to be surrounded by artistic people—including his wife, Nita Lou (a writer turned singer-songwriter), and their daughter, Zora (filmmaker and photographer).

After completing his B.S. in Chemical Engineering at Vanderbilt, Steve went on to graduate school at UT Austin, where he began to get serious about research. He did his doctoral research on the patterns that arise within sedimentary rocks when flowing water causes minerals to dissolve and precipitate. At that time, he also became an avid cyclist. Steve remembers his grad student days in Austin this way: "Getting to focus on one particular research problem, plus cycling in the same town where the national team trained-- this was great for somebody like me!" When the subject of carbon footprints comes up, Steve likes to point out he has not used a car for commuting to work since 1986. He rides or walks to work no matter what.

Much of Steve's current research is aimed at understanding pore-scale processes involving water, oil, and gas. His research results have practical applications for optimizing oil and gas production from porous reservoirs, ensuring security of CO_2 stored in geologic reservoirs, and reducing the environmental impacts of energy production. Not surprisingly, Steve prefers collaborative research projects that bring together students and faculty with diverse interests and expertise. As with music, he believes teamwork in the lab fosters creativity.

Steve is a natural mentor, and he takes great pride in sending off new graduates each Spring to jobs with industry, academia, and national labs. Perhaps his greatest gift of all is passing on his natural appetite for learning to the next generation of petroleum engineers.

NETL